Rodents: Mice

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There are several species of mice in Washington: The **house mouse** is the most common one in schools. But the **deer mouse,** also called the white-footed mouse, and the **meadow mouse,** or vole mouse, may come in when the weather gets colder in the fall. House mice can be difficult to get rid of and can lead to an invasion by rats, which feed on mice. This document covers Integrated Pest Management (IPM) techniques for control of mice.

Mouse identification

Several types of rodents can cause problems in schools. Mice are probably the most common, but rats, tree squirrels, ground squirrels and sometimes chipmunks can decide to move into a building. Knowing the type, and often the species, of rodent helps you know where to search for their sources of food and hiding places. It is essential for effective management to understand the habits and characteristics of mice and rats, in particular. Most people can identify a mouse when they see one but may find it difficult to tell a mouse from a young rat. The following diagnostic pictures are from "Field Identification of Domestic Rodents" by R. Z. Brown, U. S Department of Health, Education and Welfare, Public Health Service, Communicable Disease Center, September 1953.

House Mouse:
Small head.
Small feet.

Young Rat:
Large head.
Large feet.

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Facts about mice

Hazards of mice

Property Damage

Tremendous damage to property and food supplies results from the chewing, defecation and urination of mice. Mice contaminate far more than they actually eat or chew, because they leave urine and droppings wherever they feed. It has been estimated that in six months a mouse will have 6,000 droppings! Mouse contamination is so common that government tolerances for food permit a certain number of rodent hairs and sometimes droppings in food for human consumption.

Fire

Because they chew all the time and prefer to live near the warmth of electrical equipment, fires can be started by mice chewing on electrical wires.

Disease

Many diseases are transmitted by mice to humans.

☑ transmitted directly by mice:

- Leptospirosis, or Weil's disease, is an uncommon bacterial infection from soil, water or food contaminated by rodent urine.
- Rat-bite fever is an uncommon bacteria introduced by a rodent bite. It causes flu-like symptoms that, if not treated, can lead to cardiac inflammation and abscesses.
- Ray fungus and ringworm are both fungus diseases spread from mouse to man or sometimes from mouse to cat to man.
- Tapeworms are spread by droppings and contaminated food.
- Salmonella bacteria that causes food poisoning thrives in rodents and is transmitted when they travel over food surfaces, dishes, stored food etc.
- Meningitis (lymphocytic choriomeningitis) is a viral infection of house mice that can be spread to humans, especially children, through contaminated food or dust.
- Hantavirus Pulmonary Syndrome is a newly discovered disease (also called the Four Corners disease) that can be fatal. The transmission mode is not clear but is thought to be water, food, soil or dust contaminated with deer mouse urine and feces.

☑ transmitted by mites living on mice:

- Rickettsial pox, a chicken-pox type rash.

- Dermatitis caused by rodent mites has sometimes been mistakenly blamed on allergies, fleas and so on.

Note: Rabies has never been transmitted by mice and rabies shots are not recommended for treatment of mouse bites. **All mouse bites need medical attention** because of the bacteria and germs in their mouths.

Benefits of mice

Outdoors

Mice provide an essential food source for owls, hawks and other predatory birds and animals. They may also be important consumers of weeds and insects.

Indoors

Mice are not beneficial indoors, but if there are cockroaches or other insects in infected buildings, mice are probably eating them. Eliminating mice may result in a rise in the building's visible population of insect pests. Populations of insect pests will drop again once steps are taken to clean up the insect's access to food, water and harborage.

Mouse food

Mice need about one-tenth ounce of food a day. Mice **do not need free water**; they can survive very well on just the water in food. Their preference is for grain but they will eat just about anything. Mice are nibblers, taking only a little food at a time, which cause some special problems for poison baiting.

Preferred nest locations

Mice live in all human environments from Arctic stations to coal mines to office buildings. They may come out in the daytime but are mostly nocturnal. They don't like to be more than about 15 feet from their nests when they are patrolling their territory and searching for food.

Indoors

Mice like to nest in enclosed spaces such as drawers, wall voids, behind false ceilings and in the motor compartments of appliances such as refrigerators, stoves, heaters and air conditioners. House mice like to live inside all year but deer

mice and meadow mice prefer to live outside during the warmer months of the year.

Outdoors

Mice prefer ivy groundcovers and other dense close shrubbery that will hide their trails and nests. They also like tall weeds and dense shrubbery that shelter their entrances to the building.

The mouse life cycle

Females become sexually mature and ready to mate in 6 to 10 weeks. Pregnancy is short - about 3 weeks - until the litter of about 6 pups is born. Pups are weaned in three weeks and follow their mother, learning to survive from her. Females are fertile every four days and can have as many as 10 litters a year. Life expectancy for a wild mouse is one or two years.

In a building, their populations are only kept in check by the non-availability of food and diseases. Outdoors, their major predators are rats, snakes and owls.

Cats can keep the occasional mouse out of a home but they can't usually do more than trim a large population.

Physical abilities of mice

Mice are remarkably adapted to survive in difficult circumstances and close to humans. They can swim, but their chief skills are jumping, climbing, moving rapidly over vertical surfaces, along the top or underside of wires and traveling on either the outside or inside of pipes. Mice can squeeze through an opening larger than 1/4 inch square.

Mice cannot see very well (only about six inches). They prefer to use their other keen senses - smell, taste, hearing and touch (through whiskers and body hairs). They will use the same routes or trails and memorize them so that they are able to travel in the dark. Travel routes are usually along edges of walls, on pipes, wires or rafters.

Mice are curious but cautious. They will investigate any new object or change in their territory thoroughly. They they will readily enter a bait station.

Mice gnaw constantly because their teeth are always growing. They will enlarge existing holes around pipes and wires to get into a room or building. They can chew through soft concrete, aluminum, wall board, wood and plastic pipes.

How mice get into schools

Mice usually start a new colony in a building because their populations have grown so high in a neighboring site that the colony has to divide. Mice may be displaced by destruction of old buildings or the development of property where they had been living outdoors. Deer mice and meadow mice will come inside looking for a warm place to overwinter - especially if they are already coming in to eat.

The key to controlling mice

The keys to successful control of mice are:

- removal of their food, water and hiding sites,
- exclusion from school buildings,
- destruction of the resident population, and
- periodic monitoring to detect new populations.

A combination of techniques is usually necessary to deal with an established population.

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Rodents: Rats

There are two main species of rats in Washington: The **Norway rat** (also known as the brown rat, sewer rat and wharf rat) is found throughout the state. The **roof rat (**also called the black rat, ship rat and Alexandrine rat) is found in coastal areas of Washington. Both rat species are highly social, living in colonies and caring for their young. They are very territorial and you may hear them fighting and scrambling about in walls or between floors. This document covers Integrated Pest Management (IPM) techniques for control of rats.

Rat identification

Several types of rodents can cause problems in schools. Mice are probably the most common, but rats, tree squirrels, ground squirrels and sometimes chipmunks can decide to move into a building. Knowing the type, and often the species, of rodent helps you know where to search for their sources of food and hiding places. It is essential for effective management to understand the habits and characteristics of mice and rats, in particular

The roof rat has a more slender appearance than the Norway rat. The ears on a roof rat are larger and are large enough to be pulled down over the eye. The ears do not reach the eye on the Norway rat. They eyes are larger on a roof rat and the nose is more pointed. The head and body of the Norway rat have a much chunkier appearance. The tail is a good diagnostic sign if it is intact. A roof rat's tail is longer than its head plus its body, while the Norway rat's tail is shorter than the head plus the body.

Most people can identify a rat when they see one, but may find it difficult to tell a young rat from a mouse. A young rat has a larger head and feet in proportion to its body, like other young mammals.

The following diagnostic pictures are from "Field Identification of Domestic Rodents" by R. Z. Brown, U. S Department of Health, Education and Welfare, Public Health Service, Communicable Disease Center, September 1953.

Roof Rat

Norway Rat

Facts about rats

Hazards of rats

Property Damage

Tremendous damage to property and food supplies occurs from rat's chewing, defecation and urination. Rats contaminate far more than they actually eat or chew, because they leave urine and droppings wherever they feed.

Fires

Because they chew all the time and prefer to live near the warmth of electrical equipment, fires can be started by rats chewing on electrical wires

Disease

Many diseases are transmitted by rats to humans.

☑ transmitted directly by rats

- Leptospirosis, or Weil's disease, is an uncommon bacterial infection from soil, water or food contaminated by rodent urine.
- Rat-bite fever is an uncommon bacteria introduced by a rodent bite. It causes flu-like symptoms that, if not

treated, can lead to cardiac inflammation and abscesses.
- Salmonella bacteria that causes food poisoning thrives in rodents and is transmitted when they travel over food surfaces, dishes, stored food, etc.
- Trichinosis is an intestinal roundworm transmitted through infected pork when pigs eat rat contaminated hog food.

☑ transmitted by fleas living on rats:
- Bubonic Plague is transmitted by rat fleas. Reservoirs of the disease exist in wild rodents in several western states.
- Murine Typhus Fever comes from flea feces contamination of flea bites.

Note: Rabies has never been transmitted by rats and rabies shots are not recommended for treatment of rat bites. All rat bites need medical attention because of the bacteria and germs in their mouths.

Benefits of rats

There are no benefits to rats, but they are probably eating mice and insects in buildings they infest. Eliminating the rats may cause a rise in the visible population of other pests. Cleaning up garbage and ending rodent's access to food and water will also reduce the building's ability to support other pests.

Rat food and water

Rats need about one ounce of food a day and 1/2 to one fluid ounce of free water (not just water in food). They can detect trace amounts of chemicals in food if they have been previously exposed to the poison. They often drag food or bait away and hide it somewhere else before they get around to eating it. This is a problem because you don't want children, pets or non-target animals coming across bait that rats have dropped or moved from where you put it.

Preferred nest locations

Rats live in most human environments, but they are nocturnal. People may not notice them unless the

population pressures are so high that weaker rats are forced out of hiding during the daytime. They don't like to be more than about 150 feet from their nests when they are patrolling their territory and searching for food. They avoid open spaces. Rats prefer to nest away from human sight but close to their food and water source. The two species of rats have somewhat different preferences in nest sites and food sources.

Norway Rat - Preferred Food	Norway Rat - Preferred Nest Location
Proteins like meat, fish, insects, pet food, garbage but will eat vegetarian foods if hungry enough.	Outdoors in shallow burrows with multiple openings to their nest, rockeries and mole tunnels. Inside in walls, under insulation, under electrical equipment, in storage areas, crawlspaces and basements. lower floors of a building. Will nest in sewers and storm drains.

Roof Rat - Preferred Food	Roof Rat - Preferred Nest Location
Vegetables, fruit, nuts, seeds, and garbage but will eat meat if hungry enough.	Above ground in trees, vines, lumber, sometimes in burrows. Inside in attics, ceilings and wall voids on the upper floors of buildings. Will nest in sewers and storm drains.

The rat life cycle

Females become sexually mature and ready to mate in about 90 days. Pregnancy is short - about 3 weeks - until the litter of about 8 pups is born. Pups are weaned in five weeks and follow their mother, learning to survive from her. Females are fertile all year and have an average of 5 litters a year. Life expectancy for a wild rat is 1 year or less.

Physical abilities of rats

Rats are remarkably adapted to survival in difficult circumstances and close to humans. Norway rats are excellent swimmers and can come into a building through sewers and toilet drains. Roof rats are especially good climbers, using trees and their branches, either the outside or inside of pipes and traveling on telephone lines and wires. Both rats can squeeze through an opening larger than 1/2 inch square.

Neither rat can see very well, preferring to use their other keen senses - smell, taste, hearing and touch (through whiskers and body hairs). They prefer to use the same routes or trails, and memorize them so that they are able to

travel in the dark. Travel routes are usually along edges of walls, on pipes, wires or rafters.

Rats are very fearful and cautious of new objects or changes to their environment (neophobia). This makes it difficult to get them to take bait in new foods or to approach a trap unless they can become accustomed to it as a non-threatening presence first.

Rats gnaw constantly because their teeth are always growing. They can chew through concrete, aluminum, wall board, wood and plastic or lead pipes. They will enlarge existing holes around pipes and wires to get into a room or building.

How rats get into schools

Rats usually move into a building because their populations have grown too high at a neighboring site. Rats may also be displaced by destruction of old buildings or the development of property where they had been living outdoors. They come into the building because it has food and water or provides shelter that is close to food and water.

The key to controlling rats

The keys to successful control of rats are:

- removal of their food, water and hiding sites,
- exclusion from school buildings,
- destruction of the resident population, and
- periodic monitoring to detect new populations.

A combination of techniques is usually necessary to deal with an established population.

Methods of Integrated Pest Management:
Rodent Control

Techniques for School Personnel

Identify the Problem

If your building has a persistent or large infestation of rodents it will be much more effective in the long run to hire a pest control professional who is experienced with them than to attempt to trap or destroy them yourself. Sanitation and exclusion measures must be taken by the school staff.

Is there a rodent problem?

You will usually first find out about a rodent problem because:

You see a live rodent.

A rat or mouse seen in the daytime may be a single escaped pet that has no fear of humans, or it may indicate a resident population high enough that the weaker individuals are being driven out of their hiding places. Escaped pets are usually white or spotted rather than the black or brown of wild rats or the brown or gray of wild mice. Squirrels however, are not nocturnal and are commonly seen in the daytime.

You find dead rodents in attics, under floors or wall voids.

They may go unnoticed until they start to smell. Dead rodents out in the open may indicate that someone is poisoning them on a nearby property and the individual died before it could get to its shelter.

You hear rodents fighting.

Rodents fight over territory or for dominance of territory, and chew and move behind walls, ceilings and between floors, especially at night. Noises heard in the daytime only and on upper floors are more likely to be evidence of squirrels in the building than of rats or mice.

You find rodent droppings.

Droppings are found at active feeding areas and water sources. You can tell which rodent you have by looking at the droppings. Norway rats have blunt-ended 3/4 inch droppings, roof rats' scat are pointed on the end and 1/2 inch long. Mice leave pointed 1/4 inch droppings which look like black rice.

You find damage from chewing or gnawing.

Damage appears on stored food containers, cabinet doors, art supplies, books or other material.

Are the rodents rats, mice or squirrels?

To be certain of the rodent causing your school's problem, you need to see it. If you don't already have a dead one handy, trap another one and examine it. Identifying the rodent helps you know where to search for their sources of food and water, and nests.

Follow the guidance on trapping. Use gloves to avoid any bacteria or fleas. Use a shovel to pick up dead rats or a trap with rats in it. Young rats and adult mice may be difficult to tell apart.

The following information is from, "Rodents: Pictoral Key to Some Common United State Genera" by Harold George Scott, PhD., U. S Department of Health, Education and Welfare, Public Health Service, Communicable Disease Center, September 1962.

Deer Mouse

House Mouse

Meadow Mouse

Tree Squirrel

Ground Squirrel

Chipmunk

Note on Squirrels:

Squirrels may be locally protected or regulated under game animal laws. Squirrel trapping and releases may also be subject to laws intended to prevent the spread of rabies. If you have a squirrel problem, use the rat proofing techniques to keep them out of the building. Call your local game conservation officers for advice if you plan to kill or trap squirrels.

Find out where the rodents are getting food and water, traveling and nesting.

Important! do not disturb the runways or nests yet!

You need to keep the rodents using their accustomed places to effectively set traps or use poison bait.

☑ Find **all** of the food and water sources to eliminate the rat's access and to get them hungry enough to take bait.

☑ Find runways and paths for monitoring and trapping.

☑ Find the nests or shelters for later clean-up and to close off their access.

☑ Once these areas are found and the problem areas are cleaned up, survey them several times a year to prevent future problems. Make a map so that you can keep track of problem areas.

To find food and water sources:

Look for **sanitation conditions** that provide access to food and water, and **droppings** left where mice feed.

☑ Look around stored food and snacks in the kitchen and home-economics room, day care, locker room, outdoor eating areas or compost piles, garbage cans and dumpsters.

☑ Look around water fountains, sinks, toilets, leaks, standing water and condensation around pipes.

☑ Look outside for leaking faucets, blocked gutters, holes in sewers and drains, birdbaths and ornamental ponds.

☑ Don't overlook classrooms and teachers lounges, which can have pet food, snacks, edible art supplies or other stored food.

☑ Droppings should always be sprayed with a 10 percent bleach, 90 percent water solution before sweeping to avoid possible airborne diseases. Then sweep up

droppings and check again in a week to see if an area is active. Fresh droppings are soft but get hard and dry when they are old.

To find runways and paths:

☑ Look for greasy looking **rub marks** from rodent fur:

- Where walls join other walls, the floor and ceiling.
- Around holes where pipes or wires go through the walls, ceilings and floor.
- Along ceiling joists and sill plates.
- Where vents and other openings penetrate walls, floors and ceilings.

☑ Look for **runways** indoors and outdoors. Make a **tracking patch** if the area is dust free and indoors.

- Indoors the runway may appear dust free or polished.
- On dusty floors, the tops of partitions or ceiling beams, look for tracks and tail 'drag' marks.
- Outdoor runways are paths along walls, fences, under bushes and buildings.
- In soft soil outdoors look for tracks and tail 'drag' marks.

Note: A **tracking patch** is a 2 foot square light non-toxic dusting of clay, talc (unscented baby powder) or powdered limestone applied near runways and grease marks. Flour will attract insects so don't use it. To see tracks more clearly hold the flashlight at a low angle so that the tracks will cast a shadow.

☑ Look for **urine** around and on feeding surfaces, trails and water sources. Rat urine glows blue-white under a portable black (ultra-violet) light. Other substances can cause the glow too but it is one way to find runways and travel routes.

☑ Look for **gnawed marks and holes** in cabinet doors, stored food containers and around holes for wires and pipes. Fresh marks will be lighter in color, not weathered. Rat tooth marks are two parallel grooves about 1/8 inch across. Mouse tooth marks are about 1/16th inch across.

To find shelter and nest sites:

☑ Rat and mouse nests are made of insulation or shredded paper or fabric, 8 to 12 inches in diameter for rats and about 5 inches for mice.

- ☑ Food and water sources are usually within 150 feet of the nest area of rats and 15 feet of a mouse nest.

- ☑ To find out if a burrow is in active use plug the opening with wadded up newspaper, dirt or foil. Check 24 hours later to see if the material has been disturbed.

- ☑ A strong rodent odor may be noticeable around nesting areas in buildings.

- ☑ Listen where rodents have been heard fighting, chewing and moving behind walls, ceilings and between floors. If the nest is in a very inaccessible place, or you are not sure exactly where it is (for example in a wall), professional help may be necessary.

- ☑ Nests may be outside on the grounds in old mole run, and the rats or mice may be coming in just to feed and drink.

Norway rats nest outdoors in shallow burrows with multiple openings to their nest, such as abandoned mole tunnels. Indoors, they nest in wall voids, under floors or crawl spaces, under electrical equipment, in storage areas and basements. Don't forget to check under or above insulation. They prefer the lower floors of a building and will nest in sewers and storm drains.

Roof rats nest outdoors and above ground in trees, vines or lumber piles. Sometimes they will use burrows such as mole tunnels. Inside buildings they prefer to be on the upper floors of buildings, attics, ceilings and wall voids. If necessary roof rats will also nest in sewers and storm drains.

Mice that are indoors nest in enclosed spaces such as drawers, wall voids, behind false ceilings and in the motor compartments of appliances such as refrigerators, stoves, heaters and air conditioners. They also like dryer vents.

If **tree squirrels** have moved into your building they will be in attics and upper floor areas. They often use attics to store food and find shelter in the winter.

Ground squirrels occasionally nest under buildings in burrows hidden by vegetation around the foundation.

Sanitation and repairs to remove food and water for rodents

Sanitation plus rodent-proofing the building prevent future populations from getting established by visitors that move

in from the neighborhood. These methods will also reduce pest insect populations.

Teach staff and students the importance of sanitation and shutting off faucets and draining water for rodent control. It is essential to get the school inhabitants to participate in sanitation and food control because they can unknowingly sabotage your baiting program by leaving out food that is more attractive or easier to get to than the bait in the traps.

Improve sanitation to remove food sources

Make it so difficult for rodents to find food that they will have to take bait or go elsewhere.

- ☑ Mice need about 1/10 ounce of food a day and prefer grains but they will eat just about anything.

- ☑ Adult rats need one ounce of food a day. Norway rats prefer protein foods - garbage is ideal and roof rats prefer vegetation - fruit in landscape trees, berries, bird seed and vegetables.

The small amounts that rodents need to survive can easily be supplied if they have free access to garbage or compost, stored food, or dirty recycling areas. Both rat species will eat non-preferred food and will hoard food in hidden areas. As you start to clean up food sources rats will become more desperate to find food and may become more visible or get into food, such as art supplies, that they had ignored previously.

- ☑ Thoroughly clean floors, counters, and under appliances and kitchen cabinets every day.

- ☑ Sweep up or vacuum crumbs and food debris daily. Remember classroom pet food.

- ☑ Drain liquids and bag all food wastes, especially milk products, before they go into the garbage.

- ☑ Have school staff and students pour out liquids and rinse food out of containers before putting them out for recycling. Explain that it is a necessary step for rodent and insect control.
- ☑ Clean up spills immediately.

- ☑ Line garbage cans with plastic liners or wash them when they get dirty.

- ☑ Use metal garbage cans designed with tight fitting lids and swinging doors.

- ☑ Remove garbage daily from inside the building to rat-proof containers secured in an outdoor area, away from entrances and windows. If dumpsters are a problem try to contract for another one or for more frequent pick up

- ☑ Store all food in roach-proof containers (glass with a rubber gasket or plastic with a snap on lid). This includes snacks in or on desks.

- ☑ Store classroom pet food and edible art supplies in roach-proof containers as well.

Yard waste compost piles can be a problem if food scraps, fruit or vegetable remains from landscape trees or student gardens are mixed with grass and leaves. Keep your landscape waste compost separate from food type wastes. See the attached brochure "Easy Composting of Yard Waste" from Seattle Urban Tilth.

If the school composts food wastes, it should be put into a "Green Cone" or a worm bin. See the attached brochure "Easy Composting of Food Waste" from Seattle Urban Tilth for building a rodent-proof or resistant worm bin and advice on keeping animals from nesting in your landscape compost.

Do physical repairs to remove water sources

This is necessary for rats as well as some pest insects. All free water sources that you found walking around the building need to be repaired, dried up, drained or shut off when not in use. You may not be able to eliminate some water sources outdoors but knowing where rodents are attracted will help prevent them from building nearby nests.

- ☑ Rats need 1/2 to 1 fluid ounce daily.

- ☑ Mice do not need free water, they can survive very well on just the water in food so this step will not help a mouse eradication program except for reducing insect populations.

How to kill and remove rodents.

Find out what was done in the past to try to solve the problem, especially which baits and poisons were used. Rodents learn to avoid a poison bait if it makes them sick or kills other rodents. They may also have learned to avoid certain kinds of traps.

You have to identify the feeding places and runways of the rodents before you can begin any trapping and/or a baiting program.
Use tracking patches to estimate the population at the beginning and the population remaining as your program progresses.

Consider how likely staff, students, neighborhood pets, raccoons, squirrels and other non-target animals are to get into the areas you want to bait or trap.

Most effective and non-toxic methods:

Traps in general

Traps have many advantages over other methods to kill rodents. They are completely non-toxic, can be used in food preparation areas, and are safe around people as long as they are hidden. They are available at hardware stores and many grocery stores for any size rodent from Norway rat to mouse. They are effective on bait shy or bait-resistant rodents. With a trapping program you can see how many rodents are being killed or captured. Trapping also has the great advantage of preventing the lingering smell from poisoned rodents that die in inaccessible places.

Concerns about the ethics of trapping can be turned to motivation to correct habitat conditions.

- ☑ Wear gloves when handling traps to keep human smells off.

- ☑ Do not store any rodent traps with pesticides or near pesticide application equipment because they can pick up chemical odors that repel rodents.

- ☑ Carry a live or dead rodent in a trap on a shovel to avoid exposure to disease.

- ☑ Use many traps and put them out in one area at a time. Then move to the next target area.

- ☑ Check traps daily to remove rodents, change bait, and to check the placement of the trap.

- ☑ Always wire, nail or otherwise fasten down any trap because the rodent may be able to drag the board for some distance if several feet are free. The trap could easily end up in an area where students will find it or in some inaccessible area where you can't remove the dead rodent without opening floors or walls.

☑ If you must use traps where children might see them and tamper with them, hide snap traps and glue boards in a rat size cardboard bait station that is secured to the floor or wall.

☑ Outside buildings, small snap traps and glue boards can be hidden in a length of 3 1/4 inch PVC pipe.

Snap Traps

These are the familiar mechanical traps that snap shut, crushing an animal when the animal steps on the trigger to get a food bait and releases a spring. Traps with extended triggers can be set for a light touch. Snap traps have advantages over glue boards; they can be used over and over and will work (although they will rust quickly) in an area with high humidity or standing water. Snap traps are designed to kill the rodent immediately so they are more humane than poisons or glue boards. This also means you do not have to kill the rodent when you find it in the trap. They are effective against all rodents.

☑ Put the traps in place with the bait you will use but don't set the traps. This will get the rodents used to taking the bait on the trap and accustomed to running over it. It can take weeks to overcome a fear of traps.

☑ Traps are most effective if you put out multiple traps at one time, set end to end along a wall with the triggers facing out. Or set the traps along runways with the trigger towards the wall.

☑ Traps do not catch young rodents so you will have to trap the next generation a few weeks later.

☑ Clean the traps with detergent and lightly oil the metal parts before storage.

Live or Multiple Catch Traps

These traps use bait to catch one or several rodents in succession. The rodents are held in the trap until someone releases them. The drawback is you need to get the rodent out and release it somewhere or kill it. Using a glue board in a multiple catch trap makes it easier to get the rodents out. Multiple catch traps are more effective against mice than rats.

Glue Traps

A very sticky coating and an attractive bait are applied to a board surface. When a rodent steps on the board it's foot

is stuck fast and the rodent can't get away. Some rodents die before they are found and killed because their noses come in contact with the trap while struggling to escape and they suffocate. They are very effective against young Norway rats and mice, but are not so effective with adult rats, especially roof rats.

Glue boards require careful placement and frequent checking if they are used in a school situation. **They are a hazard to children** who come across them. An infant (in a school day care) could be at risk of suffocation if he or she encounters a glue board because there is not enough cartilage in the nose at that age to hold their face off the board and an infant does not have the strength required to get free. Infants often explore something new by sniffing and mouthing it. Older children who pick up a glue board will get their fingers caught and can easily get their hair caught with associated distress. Teachers or other nearby adults will not likely know how to get the child released.

Use vegetable oil to get the glue board free from hair, fingers, the classroom pet, etc.

Dirt, dust, water and sun will cover or damage the surface glue and make them ineffective. Using oily baits or attractants such as peanut butter will damage the surface and may let the rodent escape.

To kill a rodent on a glue board or in a live trap, put the glue board or trap into a bucket of soapy water and drown the rodent.

Attractive Baits for Rodents

Norway rat	Hot dog, bacon or liver tied to the trigger with a string.
Roof rat	Nuts, dried fruit, coconut or raisins.
Mouse	Peanut butter mixed with rolled oats, bacon grease, raisins or cereal. A cotton ball may be attractive since it is a nesting material.
Tree squirrels	Peanut butter, rolled oats, sunflower seeds, nut meats, whole corn
Ground squirrels	Rolled oats, sunflower seeds, barley.
Also try whatever food the rodents have been eating in your building.	

Sanitation and repairs to remove harborage for rodents.

Remove the nests or shelter material

Important! Do not disturb nesting places until **after** you have reduced the rat or mouse population. You need to keep them following their usual paths so that you can tell where to place the traps or rodenticides. If they are threatened they will move to another location in the building and you will have to find their new runways.

☑ Debris and clutter should not be allowed to pile up and provide shelter either inside or outside.

☑ Keep foundation walls clear of any ground covers, bushes which cover the ground or other plantings that provide cover for rodents.

☑ Cave in any rodent burrows that you find on the grounds.

Rodent-proof your building so that rodents cannot get in and cannot find a place to hide.

Important! Don't do this before you kill the rodents or you may seal them in.

Physical maintenance, improvements and repairs to the building are next to sanitation as being the most effective form of rat control. Trying to sealing off a whole building or many rooms in a old building is not practical. Concentrate efforts where there are utility lines, vents, or pipes providing both an entrance to the building and a safe travel route once they are inside. Once inside they will try to remain near food, water (for rats) and an undisturbed place to nest.

- Mice can get through a gapgreater than 1/4 inch.
- Rats can get through a gap greater than 1/2 inch.

☑ Seal exterior cracks and holes and breaks in foundations, siding, soffits and walls. Steel wool will rust so use copper gauze (Stuf-it® is one brand) or woven or welded hardware cloth covered with a fast drying interior or exterior patching compound such as Fix-all® or Concrete Patch®.

☑ Check for metal flashing and bird blocks on the roof. Sheet metal guards can be installed to block corners and beams.

☑ Block openings around pipes and utility lines coming into the building with 24 gauge galvanized sheet metal collars. If your school is in an area with rats in the sewer you can install a one-way valve in the toilets to keep rodents from swimming in.

☑ Screen all open vents with 14 gauge woven or welded galvanized sheet metal grills. You may have to use 1/2 inch mesh if this restricts air flow too much.

- ☑ Install 22 gauge galvanized sheet metal kick plates or sweeps on doors and metal jambs on windows and doors.

- ☑ Fix plumbing leaks and other sources of water. Cover floor drains with sturdy metal grates.

- ☑ Maintain your compost pile or worm bin so that it does not provide a habitat or food source for rodents. See the brochures from Seattle Urban Tilth.

- ☑ Put bird feeders on a concrete pad to make it easier to clean up beneath them.

- ☑ Trim back trees and shrubs that allow a rat to jump into a roof. Rats can jump 48 inches horizontally, 36 inches vertically or 50 feet down. Mice can jump up 18 inches and travel upside down on wires or screens.

- ☑ Put an 18 inch radius circular 24 gauge galvanized sheet metal collars on above ground wires or pipes coming into a building.

- ☑ Move dumpsters away from entrances and windows. Keep the dumpsters closed when you are not putting anything in them. If dumpsters are a problem try to contract for another one or for more frequent pick up.

- ☑ Dumpsters and outside garbage containers should sit on a paved or concrete pad to facilitate clean-up of spills.

For details and many more methods refer to: Rodent-Proof Construction and Exclusion Methods, Prevention and Control of Wildlife Damage. 1994. Great Plains Agricultural Council, Nebraska Cooperative Extension Service.

Ineffective methods

Ultrasonic Devices

Devices that emit sound beyond the human range of hearing are advertised as a way to repel a variety or insects or animals. In 1984 the Federal Trade Commission studied them and determined **they do not work.**

Techniques for Pest Control Professionals

Pest control professionals hired to eradicate rodents in a school cannot do an effective job unless the school staff

undertakes and maintains sanitation and habitat corrections such as food and garbage clean-up, building maintenance and plumbing repairs. For example, a baiting program will not work if rodents have access to preferred foods from garbage or student lockers.

Identify the Problem

An effective monitoring program is essential to eliminate any rodent population. IPM pest control contractors can usually do a more thorough trapping and monitoring coverage of a building than the school staff because of their greater knowledge of the biology and habits of the rodent species that are present and because it will be their primary job - not an additional task. Pest control companies also have monitoring methods and devices that are not used by schools.

Another consideration for hiring professionals is their ability to manage other pests that coexist with the rodents. Parasites such as fleas live on all rodents and will be looking for new hosts when large numbers of rodents are killed. Eradicating rats in a building will often cause a boom in the mouse population which was kept under control by rat predation. Eradicating mice can cause a similar increase in cockroaches.

Methods to kill and remove rodents

Most effective and non-toxic methods

Trapping

Trapping is the largest part of an IPM pest control rodent reduction program. Professionals will typically use numerous traps and have a greater knowledge of the biology and habits of the particular rodents, which allows them to avoid mistakes, wasted efforts and making the rodents more trap or bait shy. Trapping must be followed by rodent exclusion from the building and removal of rodent harborage in the building to keep another population from moving in.

Other methods that vary in effectiveness and are moderate to high toxicity

Rodenticides in food

Rodenticides mixed with bait come in different formulations to attract different rodents, including poisoned grain for mice and bait in hard wax blocks that appeals to a rodent's urge to chew. Some formulations can be added to food or grain to make custom poison baits. Unconsumed

baits must be swept or vacuumed up and disposed of according to the label's directions.

It can be difficult to get rodents to accept a poisoned bait - especially if other preferred food is available. Rats will often ignore or move bait to another place and hoard it but not eat it. A hazard of this behavior is that they may drop the bait somewhere where a child or non-target species can get it. Many rodents, especially mice, will nibble on bait to see if it makes them sick and can become bait shy very easily.

Prebaiting with a bait that is just like the poisoned bait, but is non-toxic, may be necessary to lure rodents to a different area where a toxic bait can be safely left out. Prebaiting can also get rodents to accept a bait that they are suspicious of.

With any bait the rodent is likely to crawl into a hiding place and die. It then becomes a source of smell until it is dried up or eaten by other pests in the building. A dead rodent provides a food source for pests that you don't want to encourage indoors, such as ants and beetles. A rodent that escapes outside to die can poison owls or pets that pick it up.

A **bait box** is a metal or heavy plastic tamper-proof box that hides a trap or poison bait from children, pets or non-target animals. It must be secured to the floor or a wall to prevent it from being carried away. Bait boxes must be used in areas where they will not be seen or accessed by the staff or students.

Rodenticides may be classified as multiple dose or single dose poisons. Multiple dose poisons are usually lower risk for accidental human exposures than single dose poisons because they are weaker and must be taken several times by the rodent to get a fatal dose.

Anticoagulants such as Warfarin (D-Con®) are multiple dose poisons. They work by causing the blood clotting reaction to break down, resulting in massive internal bleeding. Antidotes can be used if a human or pet gets into it although the treatment needed may be extensive. They are more effective on rats than on mice, which need to feed on the bait for a longer time. Anticoagulants are most commonly given in food baits. The baits must be fresh and other food must not be available for best results.

Non-anticoagulant poisons for use in bait are usually single dose poisons, working much faster than the anticoagulants. Some will cause bait shyness. They vary in toxicity. Zinc Phosphide comes in various formulations. It has a strong garlic odor that attracts some rodents and may warn off others. Bromethalin (Vengeance®) is single use but

slow acting. It's used for both rats and mice and comes in a meal and a pellet form.

Methods not appropriate for schools

Rodenticides in tracking powders

Rodenticides are mixed with a talc or powdery clay that is dusted into runways or harborage areas. Rodents swallow the poison when they lick and clean their fur. Rodents groom frequently so tracking powders are effective even where food and water are plentiful. They are especially effective against mice. Nevertheless, poisonous tracking powders are 5 to 40 times more concentrated than baits. They should not be used in school because they can get into air ducts or areas with air currents or food handling.

Rodenticides in water

Anticoagulant or more acute toxicants can be added to water. Usually the poisoned water is intended to be used on a chick feeder or a special dispenser fountain. They are better used in a warehouse or maintenance building than in a public area, such as a school, due to the risk of children interfering with the stations. It is effective against Norway rats, less effective against roof rats, and not very effective against mice since they will not always take free water.

Water in small feeders tends to evaporate and it can't be used where it will spill and contaminate a surface or food supplies. All other sources of water must usually be removed to draw the rodents to the water station.

Toxic Fumigants

Fumigants are rodenticides that can be sprayed into an exterior rodent burrow. The first problem is to make sure that the burrow is active and is inhabited by the rodents that you wish to target - not some other rodent. Rat and outdoor mouse burrows cannot be effectively fumigated because they are likely to have several burrows that they use or multiple entrances to the same burrow. Some rodents, such as ground squirrels, plug their burrows for protection when they hibernate and the gas will not penetrate.

Fumigants can be very dangerous if used near a building foundation because the gas can come inside if the burrows have openings under the building. It is better to put efforts into rodent exclusion, which will last longer.

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Related Publications

In addition to this fact sheet, staff working on the Integrated Pest Management in Schools Project have created eight other documents that describe the least toxic methods for controlling pests in a school setting. Call (360) 407-7472 to request any of the documents listed below:

Publication Number	**Title**
#97-420	*Integrated Pest Management in Schools Project: Carpenter Ants*
#97-421	*Integrated Pest Management in Schools Project: Fleas*
#97-422	*Integrated Pest Management in Schools Project: Flies*
#97-423	*Integrated Pest Management in Schools Project: Head Lice*
#97-424	*Integrated Pest Management in Schools Project: Cockroaches*
#97-426	*Integrated Pest Management in Schools Project: Termites*
#97-427	*Integrated Pest Management in Schools Project: Yellowjackets and other Wasps*
#97-428	*Integrated Pest Management in Schools Project: Nuisance Ants*